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ABSTRACT

"The ERIC Review" is published three times a year and announces research results, publications, and new programs relevant to each issue's theme topic. This issue explores computer networking in elementary and secondary schools via two principal articles: "Plugging into the 'Net" (Michael B. Eisenberg and Donald P. Ely); and "Computer Networks for Science Teachers" (Kimberly S. Roempler and Charles R. Warren). In addition, the following features related to networking are provided: (1) perspectives of three network users; (2) descriptions and contact information for federal K-12 computer networking initiatives; (3) a list of 27 K-12 computer networking resources; (4) a K-12 computer networking reading list containing 19 annotated references; and (5) an annotated list of 25 new publications produced or distributed by the ERIC Clearinghouses. (MES)

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THE ERIC

U.S. Department of Education
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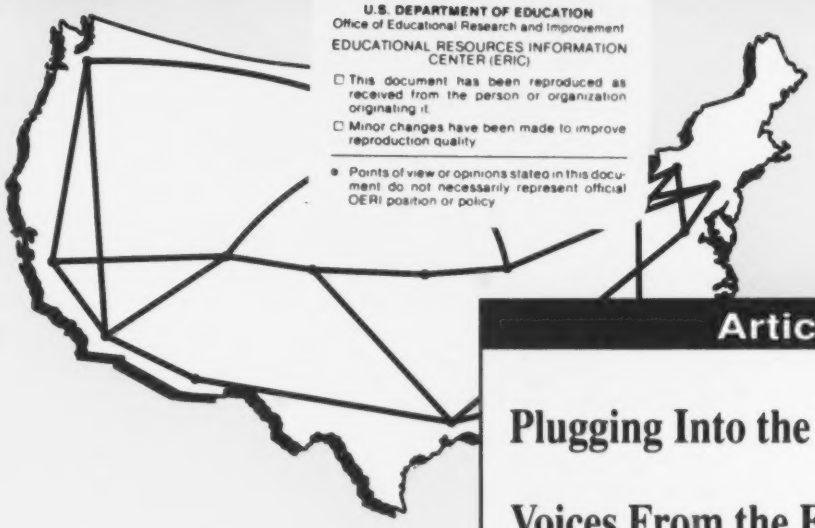
K–12 Computer Networking

View



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Articles

Plugging Into the 'Net

Voices From the Field

Networks for Science Teachers

Features

Resource Organizations

Reading List

Federal Initiatives

ERIC System Developments

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An Important Message to Our Readers

This issue of *The ERIC Review* explores computer networking in elementary and secondary schools. When teachers and students have access to a personal computer, communications software, and a modem, they can communicate electronically with others around the globe, send and receive whole files of information, and access bulletin boards and databases on subjects as diverse as creative writing and weather patterns. Computer networking can foster collaboration among educators and aid K–12 students in making use of a variety of resources for real-world problem solving.

Because computer networking is a highly dynamic field, and new networks, bulletin boards, and information services spring up almost daily, this issue of *The ERIC Review* is intended as a guide rather than a comprehensive treatise. Inside you'll find an introduction to computer networking and an overview of some of the education-related information and services accessible through various types of computer networks. Also included in this issue are lists of resource organizations and recommended readings. We hope you'll use this information as a springboard for your own exploration.

We're happy to report that many of the resources produced by the Educational Resources Information Center (ERIC) are accessible via computer networks, including the Internet, GTE Education Services, and America Online. For further details, call 1–800–LET–ERIC (1–800–538–3742).

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THE ERIC Review
Educational Resources Information Center

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ACCESS ERIC, 1600 Research Boulevard, Rockville, MD 20850.

THE ERIC Review

PLUGGING INTO THE 'NET

by Michael B. Eisenberg and Donald P. Ely

"A network of 'information superhighways' would help turn the mounting load of unused data into knowledge for problem solving."

—Vice President Albert Gore

"And I said, with my net I can get them I bet.
I bet, with my net, I can get those Things yet!"

—*The Cat in the Hat*

Introduction

Computer networks can transform common educational experiences such as class discussions, paper writing, and collaborations with colleagues into exciting and unique projects that involve the interaction of students and teachers from around the world. For example:

- At-risk students at Wenatchee High School (Washington), El Paso Technical High School (Texas), Martha's Vineyard High School (Massachusetts), and the Dumholff Special Education Center (Los Angeles, California) discuss teenage pregnancy, drug prevention, and Middle East foreign policy via their own local area network (LAN) connection to AppleLink, Apple Computer's online service. The participating students not only learn how others view and struggle with the same questions they do, but also sharpen their writing and argumentative skills by composing computer messages (Jensen, 1991/1992).

- Students of all ages prepare the newspaper *Global Village News* using input from dozens of worldwide student "news bureaus" linked through more than 15,000 free electronic bulletin boards in more than 50 countries. The paper is then distributed to thousands of users of the same worldwide network. The global newspaper is a project under K12Net, a free, international computer network for K–12 students and educators. The newspaper is further distributed through FidoNet to readers throughout the world (Rose, 1992).

- Mathematics and science classes can simulate a space shuttle journey via computer from many points in the United States as well as other countries. Students assume various roles in each simulated mission including maintaining secondary mission control, locating alternative landing sites, and docking another shuttle. The space shuttle simulation is available through Cleveland Free-Net, an electronic bulletin board and information center accessible to the thousands of users connected to the Internet (Clement, 1992).

- Teacher education faculty, student teachers, and supervising teachers can stay in close contact electronically. The University of Virginia's Teacher-LINK (Bull, Harris, and Drucker, 1992), University of Kansas' UNITE (Aust and Klayder, 1991), and Harvard University's Beginning Teacher Computer Network (Merseth, 1991) are among the networks established to enable teacher training faculty, student teachers, and teachers in the field to improve teaching by staying in touch.

This article explores the educational benefits and applications of computer networks in K–12 classrooms, presents the basics for getting started, and introduces a sampling of networks with offerings for K–12 teachers and students.

Networking Benefits

Long-distance computer networking can change teaching and learning dramatically. Teachers and students with access to a computer, a modem, and phone lines are freed from the constraints of space (the physical limits of the school building) and time (the typical 8 a.m. to 3 p.m. school day). They can communicate with peers and gain access to electronic resources as they wish, making individualized instruction and personal inquiry the norm, not the exception.

Interaction through networks helps break down communication barriers and inhibitions that often stifle the open exchange of ideas in traditional classrooms. Network use is highly motivating for both students and teachers: kids

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interact with computer networks with energy and enthusiasm often missing in more conventional classroom structures, and teachers are stimulated by the ability to share ideas, concerns, and solutions with colleagues across the country as easily as if they were in the next room.

By allowing learning and teaching to take place at any computer terminal at any time of day, education becomes "more responsive to the needs of lifelong learners in the information age" (Hunter, 1992, p. 25). The very act of using the networks for communication, learning, and information exchange makes students more likely to succeed in the rich technological and information environment of the future.

The excitement and enthusiasm for networking is not wistful speculation based on theoretical possibilities—it is happening right now. Thousands of students and teachers are tapping into networks, sharing experiences, and engaging in a wide range of learning activities (see table 1). As the pace of networking accelerates, so too will the creative uses and the overall impact of the movement.

Mastering the Basics

Computer networking, like many activities, has its own terminology. For many, part of the fun of computer networking is making sense of the "alphabet soup" of acronyms and jargon some people use. (The glossary on p. 10 will help you with that.) Using a network, however, does not require learning the technicalities and intricacies of how the connection and transfer of data actually occur. The heart of computer networking is human association and interaction, providing almost instantaneous communication across great distances. It is helpful to think of computer networking as the use of computers and telephone lines to connect people to each other.

There are many alternative ways to connect to the numerous networks; in addition, networks themselves may be networked. For example, if one person connects to Apple Computer's AppleLink, another uses AT&T's Long Distance Learning Network, and a third

Table 1: Some Educational Uses of Computer Networks

Educational Purpose	Examples
Professional collaborations among educators	Chief State Science Supervisors' Network (NSF)
	National Education Association School Renewal Network
	FrEdMail (NSF)
Students' collaborative investigations	NGS Kids' Network (NSF)
	TERC Global Change Network (NSF)
	FrEdMail (NSF)
Students' and teachers' access to scientific expertise	InSite (Indiana) (NSF and private-sector partnership)
	TeleApprenticeships (University of Illinois) (NSF)
Students' and teachers' access to information (libraries, databases, etc.)	National Geographic Weather Machine
	NASA Spacelink
Students' and teachers' access to computing resources (machines, software, etc.)	SuperQuest (NSF)
	Big Sky Telegraph
Collaborative development and electronic delivery of instructional materials	Curriculum Resources for Earth Science Teachers (Maine) (NSF)
	Engineering Education Coalitions (NSF)
Teacher education and enhancement	Teacher Link (University of Virginia)
	Mathematical Sciences Education Leadership Network (Research Council)
	Beginning Teacher Network (Harvard)
	BSCS Science Teacher Enhancement Network (NSF)
	Educational Network for American Natives (University of New Mexico)
Electronic publishing of students' products	AT&T Long Distance Learning Network
	Associated Student News Network (University of Alaska)
	K12Net

Adapted from Hunter, Beverly (1992). "Linking for Learning: Computer-and-Communications Network Support for Nationwide Innovation in Education." *Journal of Science Education and Technology*, 1 (1): 23–34.

communicates through the Internet, it is now possible for users of all three networks to contact each other.

Connection to other computers within a school or district through a LAN is not the same as using a long-distance (or wide area) computer network. A LAN involves connecting stand-alone personal computers within a limited physical setting such as a single room or floor. LANs are used primarily to enable individual computers to share printers, software, storage devices, and the like. LANs do not automatically give the user direct access to the more widespread national and global networks. An increasingly important function of LANs, however, is to provide this type of access by serving as a gateway connecting linked personal computers to nationwide and worldwide networks.

Suggestions for selecting a network and getting started are offered in the next section.

Getting Started

To get into wide area networking, you need to know the following:

- how to operate your own computer, modem, and telecommunications software;
- how to connect to and communicate with a computer already linked to the network; and
- how to use the network to communicate with others.

User manuals, classes, or general reference books (for example, Roberts, 1990; Glossbrenner, 1989) can help you master these basics.

Using a computer for telecommunications can be as fun as learning any other new computer application; it can also have its trying moments. While documentation generally comes with the myriad available modems and software packages, it is usually best to have someone available to show you how networking is done and to answer your questions. If you do not have a colleague to help you, you might seek assistance from your building's or district's library or technology staff; regional or state technology centers; or the public library. Local computer stores may provide some assistance or at least the name of a local computer users' group.

Finding a connection to a computer on a network is not always an easy task. Options include:

- **Local bulletin board systems.** Telephone dial-up to a local electronic bulletin board is a readily available and generally free connection to a computer network. More than 15,000 of these local bulletin boards cooperate to form a free global network, FidoNet, which provides local users with access to others around the globe. K12Net, a computer network for elementary and secondary teachers and students, uses FidoNet for its networking connections. FrEdMail, a network dedicated solely to K–12 education, is also based on connecting locally controlled bulletin boards operated at universities, district or county education agencies, and even local schools. Computer stores, the public library, education agencies, or computing centers at local colleges should be able to provide information about available bulletin boards in your area.

- **College and university computer systems.** Most colleges and universities provide free or low-cost accounts on their computer systems to full- and part-time students. These systems usually connect to BITNET or some other network that in turn provides access to the Internet, the worldwide network of networks. Because the university or institution pays for the service, connections for individual users are usually free. Educators who are enrolled in courses should check at their particular institutions to see what services are offered.

- **Statewide and regional systems.** Increasingly, state and regional systems are affording opportunities for K–12 educators and students to connect to the Internet. Some states, including Texas, North Dakota, Virginia, Florida, and California, provide low-cost or free connections limited to individuals and schools within the state. More and more states are providing network access for K–12 users. In addition, some of the National Science Foundation (NSF) mid-level and regional networks are providing fee-based access to the Internet. Interested persons should contact state education agencies to find out services and costs in their area.

- **School computing facilities.** Local schools and districts are just beginning to develop wide area network capabilities. Check with your building or district computer support personnel to see what is available to you.

- **Commercial vendors.** Commercial vendors provide a wide range of fee-based information resources and services, including electronic mail (e-mail) and messaging. Many of the commercial systems offer, or intend to offer, connections to the Internet (see Notess, 1992, for a list). Some commercial networks are intended for a broad base of users, while others are focused more specifically on the needs of educators. Table 2 lists a sampling of commercial networks with education-related resources and services. Contact them for more information about offerings and prices.

> ***"... you might seek assistance from your building's or district's library or technology staff; regional or state technology centers; or the public library."***

Now What?

Connection is one thing; use is another. When long-distance telephone lines were first installed, one proud promoter said that Maine would now be able to speak with Texas. A skeptical wag

rejoined by saying, "But what will Maine have to *say* to Texas?" What do users *say* once they are connected?

There are three primary uses of networks by people in education:

- E-mail, which allows computer users to carry on one-to-one communications with individuals on the same network who have interests in common. Sometimes e-mail involves a group of receivers, all of whom get the same message.

- Computer conferencing, which involves both simultaneous and delayed communication among a designated group of people. For example, a group of teachers interested in peer coaching might conduct a computer conference on the topic. They could agree to "meet" online at a specific time or contribute comments to a central computer that would make all messages available to all conference participants.

- Accessing remote sources that provide useful information to those who are connected. Examples include the ERIC database, airline flight schedules, tourist information about specific geographic areas, and health-related information. This application is like having a library at your fingertips.

Each of these uses offers opportunities to expand the learning environment, foster better communication, and excite learners and educators. They are discussed more fully in the next section.

Uses

E-Mail

Using e-mail, learners can exchange information with teachers or other learners, and teachers may communicate with students or with other teachers, either locally or worldwide. E-mail messages offer immediate access to others on the same network. In one sense, e-mail is like an answering machine using text: a sender composes a message for another individual on the network; the message is stored on the network; and the receiver can pull the message up onto the screen when he or she wants to read it. A paper copy can be made if necessary.

Table 2: Selected Commercial Networks With Education Resources

America Online
8619 Westwood Center Drive
Vienna, VA 22182
1–800–827–6364

This information service offers education discussion groups, online homework help for students, and a software library with programs in science, mathematics, language arts, and social studies. America Online also offers computer access to National Geographic's educational resources.

America Tomorrow
P.O. Box 2310
West Bethesda, MD 20827–2310
1–800–456–8881

America Tomorrow's Leadership Network and Information Service (ATLIS) is set up to allow education, business, and community leaders to share information and to work collaboratively online. ATLIS resources include news and information services and a leadership forum.

GTE Education Services
GTE Place
West Airfield Drive
P.O. Box 619810
Dallas/Fort Worth Airport, TX 75261–9810
1–800–927–3000

GTE Education Services offers several education-related databases, including the ERIC database, ERIC Digests Online, a calendar of 500 education-related conferences, and a database of 350 education information centers. Subscribers also have access to bulletin boards and information services of professional organizations such as the American Association of School Administrators (ActionLine), the National School Public Relations Association (ED-LINE), and the National Association of State Directors of Special Education (SpecialNet). The texts of *Education Week* and *Teacher* have recently become available online through GTE.

Prodigy
445 Hamilton Avenue
White Plains, NY 10601
1–800–776–0840

This online service with more than 2 million members offers many specialized bulletin boards as well as news, weather, financial and political updates, and consumer reports. Among the educational offerings for children are *Grolier's* encyclopedia; the geography game, "Where in the World is Carmen Sandiego?"; and science experiments from *Nova*.

The education applications and advantages of e-mail are many. For example:

- Teachers with limited planning time can communicate with others who are teaching at the moment without playing "telephone tag."

- Teachers, administrators, librarians, counselors, and other educators can consult with colleagues in the district and across the country on curriculum, policies, technology, and a host of other concerns.

- Students can "talk" to others across time zones and continents and get responses much more quickly than through the postal service. E-mail provides immediate feedback and captures their attention.

■ Students who use e-mail are continually working on their writing and reading skills.

■ For people who find it awkward to meet other people, e-mail provides access to friends, colleagues, and potential new acquaintances without the self-consciousness or anxiety that face-to-face meetings can bring.

File Transfer

File transfer, or sharing papers, reports, and files, is a function closely related to e-mail. File transfer can occur between two individuals on a network or involve a user accessing a central store of files located somewhere on the network. When users speak of "downloading" or "uploading," they are talking about sending or receiving files. More specifically, they refer to copying files through the network to a local site or transferring files from a local site through the network to others. For example, through file transfer:

■ teachers can send a curriculum guide and other class materials on earthquakes and volcanoes to teachers with similar interests;

■ students can share weather, demographic, and other information about their communities with others to create special projects in science or social studies;

■ librarians can locate relevant ERIC Digests (short research summaries produced by ERIC Clearinghouses on timely education topics) and other summaries of research results for a school board discussion on at-risk students and retention; and

■ administrators can receive a sample attendance procedure manual developed by another school with similar attendance patterns.

Group Communication

Beyond one-to-one e-mail, group network communication makes it easy for groups of people to work cooperatively and share information without having to be in close physical proximity. It is easy to create "global classrooms" where students work cooperatively with others as if they were in the same location. The opening examples of students discussing current topics and preparing the *Global Village News* involve groups of young people interacting over great distances through the network. National Geographic's KIDSNET is another example of group communication. It provides multiclass participation in an acid rain study that includes schools in 48 states and 18 countries.

> ***"... computer networking makes the information of the world available in the local school and even in the individual classroom ..."***

Communicating via computer with others in distant places offers unique possibilities for learning that cannot be offered in traditional classrooms. For some learners, discovering that people in faraway places share some of the same interests and concerns is a revelation that leads to further explorations of other places, customs, and ways of thinking. Network communication also helps to reduce some of the shyness and inhibition that may limit classroom participation by some students.

Teachers, administrators, and other educators also can benefit from group network capabilities. Most of the business of committees can be conducted or enhanced through sharing information and ideas with the group before and after face-to-face meetings. Networking also makes it possible to create work groups not previously feasible due to time or distance constraints.

Educators and students can also participate in discussions on topics of professional or personal interest with others who share their interests. The networks are filled with discussion groups on hundreds of topics. For example, LM_NET is a discussion group on the Internet open to all persons interested in the library media field; ALLMUSIC is an electronic conference on all forms of music in all its aspects. The EDTECH-L list is dedicated to the discussion of educational technology.

Information Access

The information age is characterized by increased access to databases, libraries, resource people, and materials that were previously inaccessible. For example, through the various networks, students can gain electronic access to newspapers, encyclopedias, weather information, space databases, humanities journals, and much more. In a real sense, computer networking makes the information of the world available in the local school and even in the individual classroom or library media center.

This is a time in which the ability to ask the right questions is more important than having the right answers. The vast storehouses of information that already exist can provide useful answers when queried appropriately. Teachers can help students ask the right questions and tap the many information sources accessible through computer networks. A few examples of the wealth of information available right now to students include:

■ research data, discussions, libraries, and additional services related to prevention of drug and alcohol abuse from California's online Drug and Alcohol Abuse Prevention Net;

■ text and commentaries of Supreme Court decisions, information on space flights and space science, and data from the U.S. Commerce Department through the Cleveland Free-Net;

■ polling data from 1960 to the present compiled by the Harris organization and *USA Today* and archived at

Harris Data Center, University of North Carolina at Chapel Hill; and

- the full text of the Federalist Papers, the U.S. Constitution, the Koran, the *World Fact Book*, and a host of other books through Project Gutenberg, a nonprofit organization seeking to prepare electronic editions of more than 10,000 books by the year 2001.

Educators, too, have the opportunity to access hundreds of interesting information resources, including the various ERIC databases. The ERIC bibliographic databases, *Resources in Education* and *Current Index to Journals in Education*, can be accessed at several different Internet sites, including Syracuse University's SUINFO. The full-text ERIC Digests are made available to all Internet users by SURANET and the University of North Carolina at Chapel Hill. These and other databases of materials from the ERIC System also are available to individuals who subscribe to online services from commercial vendors. For example, ACCESS ERIC's *Directory of Education-Related Information Centers*, *Calendar of Education-Related Conferences*, and *Directory of ERIC Information Service Providers* are available through GTE Education Services (1–800–927–3000).

Networking in Practice

Networks are growing so rapidly that it is difficult to fully document how many exist, where they are located, and how much people use them. Nevertheless, one cannot help but be impressed by the number of users and level of activity. For example, one recent study (Nickerson, April 1992) tracked interactions on Usenet, a popular grassroots network that relies on existing computer systems and network connections to distribute news messages worldwide. During a 2-week period from the end of January to the beginning of February 1992, almost 200,000 items were posted by 50,000 users at more than 18,000 worldwide sites to 2,045 different news groups. And that is just *one* network! Figure 1 depicts the matrix formed by the many computer networks that exchange electronic mail. Several of these networks and information services are discussed in this section due to their usefulness to K–12 educators and students.

Paul Peters of the Coalition for Networked Information estimates that between 1989 and 1991, the number of separate networks linked to the Internet grew 675 percent to 2,338 (Dalton, 1991). This translates to about 727,000 host computers and 1 million daily users of the Internet, with traffic increasing by 11 percent each month (Lottor, in Polly, 1992).

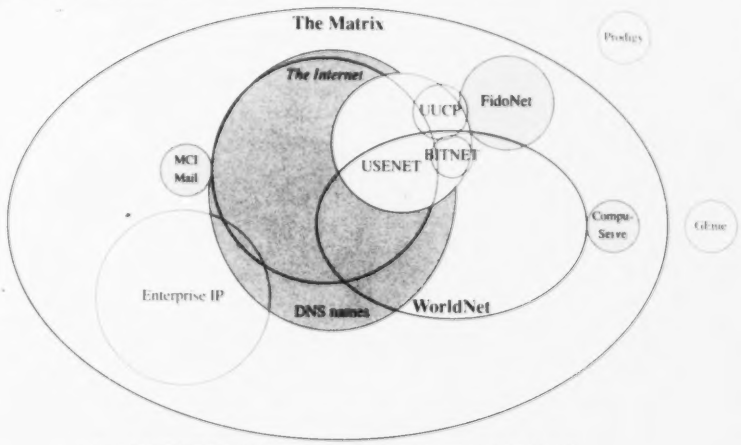
While the network usage statistics are impressive, the variety and number of projects and programs that use the network are even more striking. For example, looking just at education uses, Hunter outlined some 20 samples of networking projects related to 8 broad educational purposes (Hunter, 1992; table 1). These projects involve thousands of teachers and students worldwide.

While it is not possible to fully describe all networking projects in education, here are some network services immediately available to K–12 educators and students. More information on contacts is offered in the Resource List on p. 14.

K12Net

K12Net is one of many networks for elementary and secondary school students and their teachers. K12Net establishes "echo" forums around major curriculum areas. Educators and students interested in a particular topic can communicate and work cooperatively with other interested individuals throughout the world. For example, *Global Village News*, mentioned at the beginning of this article, is a K12Net news service involving students from around the globe. K12Net is open to anyone who has access to a local computer bulletin board. Access to K12Net is through FidoNet, a free general-interest computer network that joins more than 15,000 computer bulletin boards in more than 50 countries. While it is possible to send e-mail from FidoNet to the Internet (and vice versa), FidoNet reaches many places where the Internet does not. Also, there is no charge for using the network; a computer, modem, and telephone

Figure 1. The Matrix



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From *Matrix News*, Vol. 2, No. 7, July 1992, pp. 5–9, available from Matrix Information and Directory Services, Inc., 1106 Clayton Lane, Suite 500 West, Austin, TX 78723; (512) 451–7602.

Note: Shading is used to point out certain interrelationships among networks. USENET is a service that runs over several other networks. DNS refers to the Domain Name System, a convention for addressing mail that is used by all the hosts actually on the Internet and some that are not. FidoNet and CompuServe can be reached using a DNS address, but these networks do not use DNS internally.

connection to a local bulletin board are all that you need. To find the telephone numbers of active bulletin boards in your region, call a local computer store or your public library (Rose, 1992).

FrEdMail

Initiated in 1986, FrEdMail (Free Educational Electronic Mail Network) is the oldest and largest education network in America, linking, through the Internet, more than 150 electronic bulletin boards (called electronic mail centers) operated by individuals and institutions. Each bulletin board represents a "node" on the system and delivers Internet e-mail to as many as 300 teachers and students.

In 1991, FrEdMail helped approximately 5,000 teachers and their students participate in a wide variety of learning experiences designed to motivate students to become better learners and writers. Recent FrEdMail projects include "Acid Rain," for which students from around the country collected rain samples, plotted national data, and shared research, conclusions, and essays on the causes and effects of acid rain; and "Experts Speak," which involved one group of students assuming the personalities of various historical figures and another group interviewing them to determine their identities.

FrEdMail is also intended to promote the sharing of resources and experiences among teachers. FrEdMail accounts are free; the only costs are those related to connecting to the nearest node. Contact the FrEdMail Foundation (see Resource List) for information on finding local nodes or setting up your own e-mail center (Rogers, 1992).

Usenet

Usenet is a large, global network originally created to connect computers using the UNIX operating system. One of the major activities on Usenet is Netnews, an impressive system of discussion groups that allows users to discuss every conceivable topic, from genetic engineering to windsurfing to finding a bicycle repair shop in Denver, Colorado (Kessler, 1992). Growth of Usenet has been spectacular. In 1984, there were fewer than 2,000 connected sites and 150 newsgroups; 1989 saw 15,000 sites and one-half million readers (Nickerson, 1992). Usenet is so popular that it is now available through many Internet, campus, and local bulletin board systems. Usenet's widespread availability and range of options make it highly relevant for educators and students. A word of caution, however: educators should monitor their students' access to Usenet carefully because some newsgroups are not suitable for minors. Another concern with Usenet is the possibility of overload: the sheer volume of available information can overwhelm the new user (Nickerson, 1992). So, once you are connected to a network, check with other users or the system managers for tips on accessing and using Usenet effectively.

KIDSNET

Accessible through the Internet, KIDSNET is an international discussion group founded by Bob Carlitz for teachers and others interested in networking for children and education. Participants discuss general questions about computer networking, user interfaces, and specific projects that link teachers and students using the Internet. KIDS, an associated list just for children, was set up after children's messages to each other began appearing on KIDSNET. Educators with access to the Internet interested in subscribing to KIDSNET can send a request to: joinkids@pittvms.bitnet. Children with access to a network can post messages to KIDS by sending mail to: kids@pittvms.bitnet ("Join KIDSNET!", 1991).

State Networks

Networks are often planned and implemented on a state level. A national survey conducted by the Merrimack (Massachusetts) Education Center found that "... approximately 60 percent of the states now operate a statewide computer or telecommunications network" (Lavin and Phillipo, 1990). Some states have established their own networks to serve schools and other nonprofit organizations within their specific boundaries. The Texas Education Network (TENET) and Virginia's Public Education Network (PEN) are examples of statewide systems that connect K–12 administrators, teachers, and students for no cost or at a nominal fee. The state networks generally provide some degree of statewide services such as bulletin boards, conferencing, curriculum resources sharing, and administrative data transfer as well as a gateway to the Internet and other networks such as AppleLink, CompuServe, MCIMail, AT&T Mail, FrEdMail, and FidoNet. Educators should check with their own state education agencies for information on the network capabilities provided in their state.

The Internet

Although not an education-focused project like those mentioned above, the Internet deserves special mention because it is a means for accomplishing most of the current network educational activities. All of the existing networks and services seem to offer a hodgepodge of access points for information and communication. One might wonder if there is any way that all of them might be connected, or at least coordinated, before the thicket of networks becomes impenetrable. Fortunately, the Internet is in operation now and the National Research and Education Network (NREN) will be up and running in the near future.

The Internet is a global network of networks. Users connected at local sites are able to "talk" to colleagues worldwide. The Internet uses the high-speed capability of the National Science Foundation's NSFnet, which serves as a backbone to the Internet, to link the various national, regional, and local networks. BITNET, for example, is a national network of colleges, universities, and research sites. Through the Internet, BITNET users can interact with colleagues all over the country and the world. Many of the network educational services noted above (e.g., FrEdMail, KIDSNET) use the Internet. Others are finding ways to provide gateways into and out of the Internet (Nickerson, 1991).

Increasingly, access to the Internet is a key part of plugging into the world of networking. Millions of people currently use the Internet, and the number of nonprofit institutions and commer-

cial services offering Internet connections is growing every day. This means that educators seeking to get involved with networking should aim, whenever possible, for access to the Internet. Many of the contacts noted above (particularly local colleges and universities, libraries, and local educational agencies) as well as state education agencies can give more details about capabilities in a particular area. ACCESS ERIC can be contacted at 1–800–LET–ERIC for a listing of some possible commercial connections.

An Eye to the Future

Providing network access is already a designated national priority. In late 1991, Congress passed legislation to greatly expand the Internet through developing NREN. The intent is to improve the information, computing, and communications infrastructure for researchers and educators on all levels. NREN or any other expanded network has the potential to deliver text, graphics, full-motion video, and stereo sound. Electronic libraries, including the Library of Congress, would be able to use NREN to deliver some or all of their holdings on demand to the learner at home, at school, or in the workplace. Because NREN specifically includes K–12 educators, we are likely to see many network developments particularly targeted to the K–12 education community.

It is essential that all schools have access to computer and networking resources, not just those that can afford it. If only those schools that already have the equipment and training are able to access the networks, those without such resources will fall further and further behind. The federal government's plans for NREN specifically recognize this equity issue and include federal assistance for schools and libraries unable to take advantage of private-sector NREN connections (Bishop, 1991). States are responding as well. Texas, for example, has authorized a Technology Allotment Fund to enable less affluent schools to buy equipment if they have a plan for putting it to use.

Documenting evidence of the effects of networking is also a concern for the future. Researchers are just beginning to investigate the nature and scope of computer networking. Completed studies offer insights into factors that influence successful participation in networking. Weir (1992), for example, found that ease of access, administration support, and teachers' willingness to participate all play key roles in successful networking. Even more crucial are questions related to the impact of networking on individuals, work, and society as a whole.

Some active users speculate on the changes that networks are already bringing and might accelerate in the future. For example, Hunter (1992) speaks of educational reform and how computer and telecommunications technology can help to:

- meet the needs of our increasingly multicultural population;
- reform instructional methods and curricula to restructure schools to meet the needs of diverse students in an information society;
- forge closer links among school, community, industry, and home; and
- support collaborations across institutional boundaries and among individuals isolated from one another.

As educators, we are specifically concerned with what networking can mean for learning and teaching. We are also interested in the impact of networking on the institutions of education—schools, school districts, and state departments of education. It is expected that these serious concerns will be addressed during the next few years through a number of field and research studies.

What's in It for Educators

It is easy to get caught up in the excitement and enthusiasm of using computer networks. After "getting over the humps" of gaining access and learning how to use the networks, people become enthusiastic about the long-distance contacts they have made, the remote resources they have accessed, and the fun of their discoveries.

As noted earlier, computer networking frees education from the limits of time and space. And if schools have the necessary technologies, educators and students can gain more equitable access to expertise, information, and tools. True distance education—not simply receiving instruction from a remote location, but learners and teachers in remote locations interacting as if they were face-to-face—becomes not just possible, but preferable.

So, plug in and join the world of computer networking. Teaching and learning will never be the same.

References

Aust, Ronald, and Jim Klayder (1991). "Global Navigation in the Year 2001," in *Proceedings of the Association for Educational Communications and Technology, 1991*. ED 334 973.

Bishop, Ann P. (December 1991). "The National Research and Education Network (NREN): Update 1991." ERIC Digest. Syracuse, NY: ERIC Clearinghouse on Information Resources. ED 340 390.

Bull, Glen, Judi Harris, and David Drucker (1992). "Building an Electronic Culture: The Academical Village at Virginia," in *Empowering Networks: Computer Conferencing in Education*, edited by Michael D. Waggoner, pp. 35–53. Englewood Cliffs, NJ: Educational Technology Publications.

Carlitz, Robert D. (Summer 1991). "Common Knowledge: Networks for Kindergarten Through College." *EDUCOM Review*, 26 (2): 25–28. EJ 431 607.

Clement, John (January/February 1992). "Network-Based Collaborations: How Universities Can Support K–12 Reform Efforts." *EDUCOM Review*, 27 (1): 8–12.

Dalton, Marian L. (Fall 1991). "Does Anybody Have a Map? Accessing Information in the Internet's Virtual Library." *Electronic Networking*, 1 (1): 21–29. EJ 436 229.

Glossbrenner, Alfred (1989). *The Complete Handbook of Personal Computer Communications: Everything You Need To Go Online With the World*, 3rd. ed. New York: St. Martin's Press.

Hunter, Beverly (1992). "Linking for Learning: Computer-and-Communications Network Support for Nationwide Innovation in Education." *Journal of Science Education and Technology*, 1 (1): 23–34.

Jensen, Eric (December 1991/January 1992). "At-Risk Students Online." *The Computing Teacher*, 19 (4): 10–11. EJ 438 043.

"Join KIDSNET!" (December 1991). *NYSERNET User*, 2 (2): 6.

Kessler, Jack (1992). *Directory to Fulltext Online Resources 1992*. Westport, CT: Meckler.

Lavin, Richard J., and John Phillipo (November 1990). "Improve School-Based Management Through Intelligent Networking." *T.H.E. Journal (Technological Horizons in Education)*, 18 (4): 69–71.

Lottor (January 1992). "Network Working Group Request for Comments: 1296." Available electronically on the Internet, cited in Polly, see below.

Merseth, Katherine K. (March/April 1991). "Supporting Beginning Teachers With Computer Networks." *Journal of Teacher Education*, 42 (2): 140–147. EJ 430 626.

Nickerson, Gord (September 1991). "Networked Resources: The Internet." *Computers in Libraries*, 11 (8): 25–29. EJ 434 705.

Nickerson, Gord (April 1992). "Networked Resources: Usenet." *Computers in Libraries*, 12 (4): 31–34. EJ 444 822.

Notess, Greg R. (September 1992). "Gaining Access to the Internet," *Online*, 16 (5): 27–34.

Polly, Jean Armour (June 1992). "Surfing the Internet: An Introduction." *Wilson Library Bulletin*, 66 (10): 38–42, 155.

Roberts, N., G. Blakeslee, M. Brown, and C. Lenk (1990). *Integrating Telecommunications Into Education*. Englewood Cliffs, NJ: Prentice-Hall.

Rogers, Al (1992). "Linking Teachers and Students Around the World," available electronically on the Internet or contact the FrEdMail Foundation (see Resource List).

Rose, Mike (May/June 1992). "Are You Plugged Into the Global Classroom?" *American Teacher*, 76 (6): 8–9.

Tennant, Roy (April 1992). "Network Basics." *Computers in Libraries*, 12 (4): 55–57. EJ 444 825.

Weir, Sylvia (1992). "Electronic Communities of Learners: Fact or Fiction." Working Paper 3–92. Cambridge, MA: Technical Education Research Centers.

Glossary

Account—A business arrangement between a network and a network user that gives the user a unique name and password through which to access the network.

Address—A unique name or number that identifies a computer user or computer; used in network communications to transmit messages to a particular person or machine.

ASCII (American Standard Code for Information Interchange)—A standard method for encoding characters; includes codes representing upper- and lowercase letters, numerals, and punctuation.

Bulletin board—A computerized forum that allows network users to express concerns, ask questions, offer ideas, and receive feedback from other network users. Often organized around a topic of common interest.

Conferencing—Online "meeting" of a designated group of people to discuss a topic of common interest.

Database—A collection of information organized to allow users to search and retrieve contents that interest them. A database might include weather information for the 50 states, descriptions of model programs in a certain subject area, or documents on various topics in education.

Download—To use telecommunications software and a modem to copy a file of information through a network for use at a local computer.

Electronic mail (e-mail)—Messages sent through a communications network from one computer user or group to another.

File server—A computer used primarily to store files and provide network users with access to those files.

FTP (file transfer protocol)—A protocol allowing a user linked to one Internet host to access and transfer files from another host over a network.

Gateway—A computer that connects two or more networks using different protocols or allows incompatible applications to communicate. Also used in a general sense to refer to providing direct access to other remote networks or services.

Gopher—Client/server software developed at the University of Minnesota to provide flexible access to resources such as databases available via the Internet.

Host—A computer offering resources and services that an individual user may access through application programs such as telnet and FTP.

Internet—The international network of networks based on the TCP/IP protocol. Also, with a lowercase *i*, any interconnected set of networks.

Local area network (LAN)—A group of computers linked together within a limited physical space, usually to share printers, software, and the like.

Modem—A device that enables computers to communicate over telephone lines.

Network—A group of computers that can communicate electronically.

Node—A single computer within a network.

NREN (National Research and Education Network)—A proposed "electronic information highway" or national networking infrastructure that will support communication across the scientific, government, defense, business, academic, library, and K–12 communities.

Online services—Information resources such as news or databases available through a network to computers equipped with a modem and telecommunications software.

Protocol—The rules governing network interaction; determine where, when, how, and in what format information is transmitted.

TCP/IP (Transmission Control Protocol/Internet Protocol)—A common designation for the Internet suite of protocols; originally a U.S. Department of Defense standard protocol.

Telnet—An Internet protocol enabling a user at one site to gain access to the commands and programs of a host at another site; also used to refer to the program that allows this remote login.

Terminal emulation—Software that enables a personal computer to communicate with a host computer by transmitting in the form required by the host's terminals.

Upload—To use telecommunications software and a modem to transfer files from a local computer through a network to another computer.

Usenet—A UNIX-based network that supports the distribution of messages worldwide.

WAIS (Wide Area Information Servers)—Client/server software that allows for a consistent approach to searching in, and retrieving information from, various databases; based on the Z39.50 protocol for exchanging information between dissimilar computer systems.

Wide area network (WAN)—A long-distance computer network that enables computers not physically linked to communicate with each other through modems.

VOICES FROM THE FIELD

Computer networking has much to offer educators, students, and parents. Networks break down the time and distance constraints of many other means of communication and make it possible to tap into almost unlimited resources. How is networking being implemented? What is the perspective from the field? Some avowed networkers offer their views.

Jean Armour Polly

Manager of Network Development and User Training, NYSERNet, Syracuse, NY

Jean Armour Polly envisions a day in the not-too-distant future when students will come into a public library to do a multimedia report on the Challenger space shuttle disaster. They will walk past the place where the reference books and vertical files used to be kept and sit down at a computer station. With a little help from a reference librarian, they will use the Internet to gain access to NASA inquiry files, analyze the technical specifications for the failed O-rings, and review the news footage. "It's really the future of the public libraries to provide this kind of information," Polly said.

In her tenure as assistant director for public services at the Liverpool (NY) Public Library, Ms. Polly laid the groundwork for providing public access to the Internet. Through a grant from NYSERNet, she was able to establish a connection as an Internet node. Polly and her staff spent months experimenting with the network. "It was always in the forefront of my mind to bring connectivity to the Internet to our library's computer lab for the public, not just to get mail, but to FTP and telnet," she said.

Awareness of the Internet is starting to grow among public library patrons. "There's a little bit of a swell as people start to realize what's out there," said Ms. Polly. "Some college students come back over break and want to telnet to their college systems. Some patrons are starting to say they've heard there's a way to search library catalogs all over the world. . . " Library patrons in Liverpool have already had one opportunity to explore electronic networking: during a 2-day period during the Persian Gulf War, patrons sent more than 700 electronic mail messages via GEnie to troops stationed in the Middle East. "Networking doesn't have to be hard," said Ms. Polly. "We just need to build gateways so people can use nets without having to know all the technical details."

Staff in some public libraries are concerned about the difficulty of justifying the purchase of computers, communications software, and modems, particularly during times of tight funding. Ms. Polly encourages them to provide the leadership and training necessary for the public to take advantage of electronic communication. She reports that at the Liverpool Public Library, where patrons have had longstanding access to computers, printers, and circulating software, "people see it as just another library service, one they've paid taxes for. We're very much driven by the public and what they want. There's so much out on the network that librarians will be needed as signposts and tour guides to locate it."

Connie Stout

Director, Texas Education Network (TENET), Austin, TX

Connie Stout, director of TENET, oversees an ambitious statewide effort to enable her state's K–12 educators and students to communicate electronically, share resources, and gain access to databases available on the Internet, a network of networks. More than 15,000 educators and administrators currently use the network to collaborate and to tap into various sources of electronic information. "Recently a new science teacher put up a message asking for ideas on how to improve his teaching," Ms. Stout reported. "TENET allowed him to ask questions and get responses from several more experienced teachers. It gives teachers a sense of camaraderie."

TENET also has many classroom applications. Students in the Cajun area around Beaumont, for example, have exchanged information about their community and economy with students in the west Texas city of El Paso. High school students have used the network

to respond to letters to Santa Claus written by elementary students. In some middle schools, students have downloaded weather information and tracked hurricanes.

Although it is too early to evaluate the educational outcomes of TENET, Ms. Stout believes networking encourages teachers to teach in a different way. "We're seeing teachers act more as facilitators," she said. "They help students find answers to questions on a higher level."

Ms. Stout noted that leadership for using TENET comes from the building level. "The key change agent in a school is the principal. We try to put up a lot of information for them," she said. To help teachers feel comfortable with networks, TENET includes traditional information sources such as a daily newspaper and an encyclopedia set. "We have to go for what they know," said Ms. Stout. "If teachers find familiar resources on the network and use them every day, they're more likely to feel comfortable about using it for other things."

Of course, successful networking requires a basic level of equipment and knowledge. "If we truly hope to change education," said Ms. Stout, "then we have to have the infrastructure in place. Right now, it's hard to teach preservice teachers to use computer networks without the availability of a computer lab." Computer equipment also is in short supply in some schools in poorer parts of Texas. The Texas state legislature has established a fund to help these schools buy equipment.

TENET eventually will be available to all 200,000 of the state's K–12 teachers. Participating teachers or schools will pay only a small startup fee and online connect charges to 1 of 16 Internet sites across the state. "We want to give everyone local-number access to the Internet," said Ms. Stout. "If they're far away from one of the sites, we'll offer toll-free remote lines. We want to see networking become institutionalized. It has tremendous potential for education."

> ***"If we truly hope to change education . . . we have to have the infrastructure in place."***

David Hughes

Consultant, Big Sky Telegraph, Colorado Springs, CO

Dave Hughes, a retired Army colonel, systems integrator, and self-described "cursor cowboy," has been online since 1979. He provides design and technical support for Big Sky Telegraph, an electronic bulletin board–based telecommunications system begun in Montana in 1987 to allow rural educators to communicate with each other and take recertification courses. Many rural educators were quick to embrace the technology because it reduced the need for costly and time-consuming travel and encouraged collegiality in a state where there are still more than 100 one-room schools.

Hughes sees the adaptation of networking in schools across the country as a developmental, evolutionary process. "Schools don't have to wait for the NREN or buy high-end computers," he said. "The key is appropriate and distributed technology." In fact, he views hardware and software decisions as base-level concerns. "Everyone is worried about bits and bytes, but we need to explore the principles of learning and teaching online. After we master the culture, we'll need to move on to specific subject applications. Teaching mathematics online is certain to be different from teaching English online."

Hughes believes all students need to become proficient in telecommunications. "Technology in education is too often for the gifted and talented or the exceptional student. If we're going to have an egalitarian society, everyone, from K to 99, needs access to information."

To Hughes, telecommunications is the key to lifelong learning. "Young kids need vertical connectivity to minds brighter than theirs. Telecommunications helps them learn subjects and learn how to learn. It also fits the needs of the work force of the future, which will be transient, collaborative, and autocratic."

Federal K–12 Computer Networking Initiatives

The federal government provides most of the funding for the National Science Foundation Network (NSFNet), the Internet "backbone" or high-speed network that connects various regions across the country. NSFNet is sometimes referred to as the interim National Research and Education Network (NREN) because it is expected to evolve into the NREN authorized by the High-Performance Computing Act of 1991 (Public Law 102–194).

The U.S. Department of Education and other federal agencies sponsor several programs and projects that promote using computer networks to improve elementary and secondary education. In addition, some federally sponsored databases are accessible through the Internet for use in the classroom.

Within the U.S. Department of Education, the Office of Educational Research and Improvement (OERI) is developing SMARTLINE, an electronic information service designed to provide education information to educators, parents, and community leaders. Research findings, descriptions of exemplary programs, and funding sources are among the kinds of information expected to be made available through SMARTLINE.

To explore the implications of technology in education, OERI sponsors the national Center for Technology in Education (CTE), operated by Bank Street College of Education in New York. CTE has undertaken collaborative research projects on education technology with researchers at Bolt, Beranek and Newman Laboratories; Harvard University; Brown University; and the National Center on Education and the Economy.

The Technology Resources Center in the Research Library of the U.S. Department of Education is a demonstration site for visiting educators and members of the public who want to see and sample computer technology available for use in the schools.

Also within OERI, the Star Schools program provides demonstration grants to telecommunications partnerships to develop audiovisual facilities and equipment, create instructional programming, and provide technical assistance to improve instruction through the use of technology. Star Schools activities benefit schools serving low-income (Chapter 1) students and other traditionally underserved populations.

The Office of Special Education and Rehabilitative Services (OSERS) is another division within the U.S. Department of Education exploring technological applications in education. OSERS' Technology, Educational Media and Materials for Individuals With Disabilities program supports activities that advance the use and effectiveness of these teaching aids to improve outcomes for children and youth with disabilities.

In the subject areas of science and mathematics, K–12 computer networking is the wave of the future. The executive-level Office of Science and Technology Policy has established the Federal Coordinating Council for Science, Engineering and Technology (FCCSET) to coordinate interagency activities in mathematics, science, and engineering education from preschool to postdoctorate levels. FCCSET's Committee on Education and Human Resources has identified educational technology as a key funding priority across all federal agencies. The National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA) are among the agencies with existing programs in this area.

NSF's Application of Advanced Technologies Program supports the research, development, and demonstration of state-of-the-art computer and telecommunications technologies in education. NSF also is working to increase the number of science and mathematics teachers who use educational technology, including networks, in the classroom. NASA has created Spacelink, a computerized electronic bulletin board that enables teachers and students to receive information about NASA programs, historical and astronaut data, lesson plans, and classroom activities.

Contact information for these initiatives is provided below.

National Aeronautics and Space Administration
300 E Street SW
Washington, DC 20546

- Committee on Education and Human Resources, Federal Coordinating Council for Science, Engineering and Technology (document distribution)
  (202) 453–1287
- Spacelink (electronic bulletin board number)
  (205) 895–0028

National Science Foundation
1800 G Street NW
Washington, DC 20550

- Applications of Advanced Technologies Program
  (202) 357–7064

U.S. Department of Education
555 New Jersey Avenue NW
Washington, DC 20208–5570

- Office of Educational Research and Improvement
  - Center for Technology in Education
    (212) 222–6700
  - SMARTLINE
    (202) 219–2050
  - Star Schools Program
    (202) 219–2116
  - Technology Resources Center
    (202) 219–1699
- Office of Special Education and Rehabilitative Services
  - Technology, Educational Media and Materials for Individuals With Disabilities
    (202) 205–8123

Academy One

Affiliated with the National Public Telecomputing Network (NPTN) and the Cleveland Free-Net, this program aims to create a "national online information cooperative for K–12 telecomputing activities." Academy One allows schools throughout the world to access the resources of its community computer systems and participate in a variety of online projects and events. Participants contribute services, features, and programs to the network for others to use. Academy One publishes a free newsletter during the school year. Internet access to Academy One is offered through the Cleveland Free-Net Telnet to: FREENET-IN-A.CWRU.EDU, FREENET-IN-B.CWRU.EDU, or FREENET-IN-C.CWRU.EDU. 6330 Lincoln Avenue, Suite 117, Cypress, CA 90630; (714) 821–4472. Program contact: Linda Delzeit, NPTN Director of Education. Internet: AA002@NPTN.ORG. (For information about NPTN, contact T.M. Grudner, President, Box 1987, Cleveland, OH 44106; (216) 368–2733; Internet: TMG@NPTN.ORG.)

AppleLink

This official online information resource of the Apple Computer community offers a K–12 Education Area with special information for classroom teachers and computer coordinators. Menu selections include reviews of Macintosh education software; a discussion forum for dialogues and news; listings of conferences and other events for K–12 educators; news about education-related Apple products; and other resources, including grant opportunities, lesson plans, and research results. Access to the K–12 Education Area is through general AppleLink membership, which now includes more than 40,000 Macintosh users worldwide. Information is available from Apple sales representatives. Program contact: Lisa Bauer, Mail Stop 41–D, Apple Computer, Inc., 20525 Mariani Avenue, Cupertino, CA 95014; (408) 996–1010.

AT&T Learning Network

This curriculum-based telecommunications program for grades K–12 matches students and teachers in "learning circles" with 8 to 10 other classes around the world. The program reinforces collaborative learning through a structured, committed partnership between all matched classes. P.O. Box 6391, Parsippany, NJ 07054; 1–800–367–7225. Program contact: Joan Fenwick.

California Technology Project

This project, operated collaboratively by the California State University system and the California Department of Education, sponsors the California Online Resources for Education (CORE). CORE provides K–12 teachers with electronic access to e-mail, the Internet, and education-related curriculum materials. Currently, 6,000 teachers use CORE, dialing into 20 California State University campuses. The California Technology Project is also developing a Graphical User Interface Design for Educators (GUIDE) to help teachers access e-mail, Netnews, and databases in a windows-type environment rather than with commands. The GUIDE will be available for Macintosh and IBM personal computers for $35 in early June. In California, call 1–800–272–8743; outside of California, call (310) 985–9631. Program contact: Keith Vogt. Internet: KVOGT@EIS.CALSTATE.EDU.

Center for Children and Technology

This research center also serves as the National Center for Technology in Education, a project of the Office of Educational Research and Improvement, U.S. Department of Education. The center investigates the roles of technology in children's lives—both in the classroom and in general—and the design and development of prototypical software that supports engaged, active learning. It offers a free quarterly newsletter and low-cost publications. Bank Street College of Education, 610 West 112th Street, New York, NY 10025; (212) 875–4560. Program contact: Margaret Honey. AppleLink: CTE.BCS. Internet: MHONEY@PRIME.BNKST.EDU.

Consortium for School Networking (CoSN)

CoSN is a community of organizations, government agencies, corporations, and individuals with an interest in K–12 education. Through computer networking, CoSN helps educators and students access information and communications resources that will increase their productivity, professional competence, and opportunities for learning and collaborative work. P.O. Box 65193, Washington, DC 20035–5193; (202) 466–6296. Internet: COSN@BITNIC.BITNET. Program contact: Connie Stout.

The EDUCOM K–12 Networking Project

This project aims to link practitioners in primary and secondary education through computer-mediated communication networks, and, with this connectivity, to develop networked resources to support curriculum reform and institutional restructuring. Current and

planned activities include developing directories of K–12 people and resources and a user orientation packet, including primers and guides to training resources; seeking avenues for business and industry collaboration; and conducting outreach to key practitioners and policymakers. EDUCOM, 1112 16th Street NW, Suite 600, Washington, DC 20036; (202) 872–4200. Program contact: John Clement. AppleLink: EDUCOM. Internet: CLEMENT@EDUCOM.EDU.

Electronic Frontier Foundation (EFF)

This membership organization focuses on policy issues related to national networking. In the K–12 context, EFF concerns itself with policies for determining the resources to which students will have access. EFF publishes a free newsletter, *EFFector Online*, on general Internet topics. 666 Pennsylvania Avenue SE, Washington, DC 20003; (202) 544–9237. Internet: EFF@EFF.ORG.

ERIC Clearinghouse on Information Resources (ERIC/IR)

ERIC/IR is one of 16 clearinghouses in the ERIC System, which is sponsored by the Office of Educational Research and Improvement, U.S. Department of Education. ERIC/IR specializes in educational technology and library/information science and processes documents in these areas for the ERIC database. The clearinghouse also provides user services and publications related to its scope areas, including the *ERIC Networker*, electronic "help sheets" for using ERIC resources on the Internet. 030 Huntington Hall, Syracuse University, Syracuse, NY 13244–2340; (315) 443–3640. Internet: ERIC@SUVM.ACS.SYR.EDU. Program contact: Nancy Preston.

The FrEdMail Network

This cooperative consortium maintains a distributed and low-cost telecommunications network for public agencies such as schools, libraries, cities, and community service organizations. FrEdMail is dedicated to K–12 education, helping teachers and students participate in a wide variety of learning experiences and exchange information freely and simply. FrEdMail features learning projects that motivate students to become better learners and writers. It also lets teachers share experiences, ideas, and materials as well as information for professional development, and provides a gateway to the Internet. FrEdMail publishes a quarterly newsletter and guides to help teachers implement telecomputing. FrEdMail Foundation, P.O. Box 243, Bonita, CA 91908; (619) 475–4852. Program contact: Al Rogers. Internet: AROGERS@BONITA.CERF.FRED.ORG.

Florida Information Resource Network (FIRN)

More than 3,000 teachers and administrators in Florida have set up free accounts for e-mail on FIRN. FIRN users also can access the ERIC database and library card catalogs of several colleges and universities in Florida through the network. To aid teachers in instructional planning, FIRN posts curriculum guides for using resources such as CNN, *Newsweek*, and the Discovery Channel in the classroom. Florida Education Center, Room B1–14, 325 West Gaines Street, Tallahassee, FL 32399; (904) 487–0911.

IBM/National Education Association (NEA) School Renewal Network

Dedicated to school reform, this electronic network is intended to create a research base by a community of actively engaged practitioners and researchers. Participants include partners in the NEA National Center for Innovation's programs, federally funded research and development laboratories and centers, several research universities, and schools from other national school reform efforts. NEA National Center for Innovation, 1201 16th Street NW, Washington, DC 20036; (202) 822–7783. Program contact: Shari Castle.

International Society for Technology in Education (ISTE), Special Interest Group for Telecommunications (SIG/Tel)

The largest international nonprofit professional organization serving computer-using educators, ISTE is dedicated to the improvement of education through the use and integration of technology. ISTE-Net, an online computer network for ISTE members, is available through GTE Education Services (1–800–927–3000). The Special Interest Group for Telecommunications publishes a newsletter about telecommunications in education, *T.I.E. News*. 1787 Agate Street, Eugene, OR 97403–1923; (503) 346–4414. Internet: ISTE@UOREGON.EDU. Program contact for SIG/Tel: Lynne Schrum. Internet: SCHRUMLM@SPLAVA.CC.PLATTSBURGH.EDU.

K12NET

This network is a system of more than 250 linked bulletin boards carrying thousands of messages each week among sites around the world. Participants access many subject-specific conferences and also collaborate on projects. Developed as a grassroots project, K12Net is a collaborative effort available free to anyone who can access it through a bulletin board. For more information, contact Janet Murray, 1151 SW Vermont Street, Portland, OR 97219; (503) 280–5280. Internet: JMURRAY@PSG.COM.

KIDSNET

KIDSNET is a global Internet electronic discussion group for children and their teachers. Ongoing discussions deal with general questions about computer networks and user interfaces and specific projects linking groups of children in one school or another. A spinoff of the KIDSNET list is another list called KIDS, which allows children to post messages to other children. To subscribe, send an e-mail request to JOINKIDS@VMS.PITT.EDU. Program contact: Bob Carlitz. Internet: CARLITZ@VMS.CIS.PITT.EDU.

Learning Link National Consortium

Learning Link is a computer-based, interactive communication system for K–12 educators, students, adult learners, and public television viewers. It features databases and information resources, message centers, and mail and gateways to remote sites. Its services are locally managed and operated by public broadcasting stations, education agencies, or community organizations in 13 states. A national version is available to those who do not have access to the local version. The national consortium provides technical support and editorial content; site operators tailor the services to meet community needs. WNET/13, 356 West 58th Street, New York, NY 10019; (212) 560–6613.

Merit/NSF Information Services

Merit Network, Inc., which operates the NSFNet backbone, also provides information support services to the networking community through e-mail or telephone. Staff offer help in using the Internet and information about K–12 connections and resources. Merit publishes a free newsletter, *Link Letter*, which can be requested through e-mail to NSFNET-LINKLETTER-REQUEST@MERIT.EDU. To obtain hard copies, write to the organization. Merit Network, Inc., 2901 Hubbard, Pod G, Ann Arbor, MI 48105–2016; 1–800–66–MERIT or (313) 936–3000. Internet: NSFNET-INFO@MERIT.EDU.

National Geographic Kids Network

Kids Network is an international telecommunications-based science and geography curriculum for fourth- through sixth-graders created by the National Geographic Society and Technical Education Research Centers, Inc. Students at schools in 50 states and more than 20 countries are assigned to research teams composed of 10 to 15 different classes. They investigate topics such as the water supply, weather, pollution, nutrition, and solar energy on the local level, then compare data with other members of their research team. Scientists help them trace geographic patterns in the data through letters, maps, and graphs. A Spanish-language version of the curriculum is being piloted. For prices and session dates, contact National Geographic Society, Educational Services, Washington, DC 20036; 1–800–368–2728.

National Science Foundation's Network Service Center (NNSC)

The mission of NNSC is to collect, maintain, and distribute information about NSFNet and provide assistance to networking end users. NNSC maintains the *Internet Resource Guide*, which is available through anonymous file transfer protocol at NNSC.NSF.NET, directory resource-guide. This and other resources can also be obtained by sending e-mail to INFO-SERVER @NNSC.NSF.NET, and typing in the body of the message:

Request: info
Topic: help

NNSC also offers network assistance through e-mail and a telephone hotline. 10 Moulton Street, Cambridge, MA 02138; Hotline: (617) 873–3400. Internet help: NNSC@NNSC.NSF.NET. Program contact: Corinne Carroll.

New York State Education and Research Network (NYSERNet)

NYSERNet is a regional network of the National Science Foundation's NSFNet and the Internet. NYSERNet links more than 70 state institutions of higher education, industries, government agencies, libraries, and schools to each other and to the Internet. It includes a K–12 networking interest group. 111 College Place, Syracuse, NY 13244–4100; (315) 443–4120. Internet: INFO@NYSERNET.ORG.

Northwest Regional Educational Laboratory (NWREL)

A program of the Office of Educational Research and Improvement, U.S. Department of Education, NWREL seeks to improve schools and classroom instruction in the states of the northwest. NWREL has a special interest in education technology and networking, and offers publications and a free newsletter, the *Northwest Report*, to a national audience. 101 Southwest Main Street, Suite 500, Portland, OR 97204; (503) 275–9500. Program contact: Jerry Kirkpatrick.

SENDIT

SENDIT is a pilot K–12 computer network for North Dakota educators and students developed by the North Dakota State University (NDSU) School of Education and Computer Center. Currently, the host NeXT computer may be accessed through six toll-free and four local numbers in

North Dakota. More than 70 forums have been established for topical discussions; educators also have limited access to the Internet. Box 5164, NDSU Computer Center, Fargo, ND 58105; (701) 237–8109. Program contact: Gleason Sackman. Internet: SACKMAN@PLAINS.NODAK.EDU.

SouthEastern Regional Vision for Education (SERVE)

A program of the Office of Educational Research and Improvement, U.S. Department of Education, SERVE focuses on improving education in the southeastern region of the country. SERVE-Line is an online information system offering educators news and product announcements, instructional software that can be downloaded ("shareware"), discussion groups, and e-mail. Users may also request a free ERIC search; results will be mailed in approximately 2 weeks. Nonmembers with telecommunications software and a modem can get limited access to SERVE-Line through 1–800–487–7605. For more information or a membership, contact SERVE, 41 Marietta Street NW, Suite 1000, Atlanta, GA 30303; 1–800–659–3204.

SpecialNet

In operation since 1981, this information network offers educators and administrators e-mail, bulletin boards, conferencing, and databases that address various topics in special education. Sponsored by the National Association of State Directors of Special Education, it includes a variety of bulletin boards maintained by editors with expertise in the fields covered, including learning disabilities, parent involvement programs, and special education litigation. For subscription information, contact GTE Education Services, GTE Place, West Airfield Drive, PO Box 619810, Dallas/Fort Worth Airport, TX 75261–9810; 1–800–927–3000.

Technical Education Research Centers (TERC)

This program researches, develops, and disseminates innovative programs for educators. A special interest is curriculum projects involving telecomputing. Services include outreach, technical assistance, curriculum guides, and information dissemination. TERC also publishes a free newsletter, *Hands On!* 2067 Massachusetts Avenue, Cambridge, MA 02140; (617) 547–0430. Program contact: Ken Mayer. Internet: KEN_MAYER@TERC.EDU.

Texas Education Network (TENET)

TENET currently links more than 15,000 K–12 educators and administrators who use the network for e-mail, resource sharing, and access to databases via the Internet. Among the offerings made available to TENET users are news services, reference materials, and full-text ERIC Digests. As TENET expands, users will be able to access the Internet through a local call to 1 of 16 sites across the state or through a toll-free number. Texas Education Agency, 1701 North Congress Avenue, Austin, TX 78701; (512) 463–9091.

Virginia's Pen

Approximately 6,000 educators currently have accounts on Virginia's statewide network. They can access Virginia's Pen via a local call to one of several sites across the state or through a toll-free line if they are located in a remote area. Network offerings include various discussion groups, topical news reports, study skills guides, and curriculum resources. Through History Online, students and teachers can pose questions to designated historians who will respond in the character of key historical figures, including Thomas Jefferson and James Madison. Virginia Department of Education, 101 North 14th Street, 22nd Floor, Richmond, VA 23219. Program contact: Harold Cathern. Internet: HCATHERN@VDOE386.VAK12ED.EDU.

For Your Information

ERIC Clearinghouses and Support Components Accessible Via the Internet

The ERIC System is continually looking for ways to become more accessible to its users. Taking advantage of online networks is the latest step. You can now reach the ERIC Components through the Internet addresses below:

Federal Sponsor:

Educational Resources Information Center (ERIC)
U.S. Department of Education
Office of Educational Research and Improvement
V5A@CU.NIH.GOV

Clearinghouses:

Adult, Career, and Vocational Education
ERICACVE@MAGNUS.ACS.OHIO-STATE.EDU

Counseling and Personnel Services
CHRIS.ELDRED@UM.CC.UMICH.EDU

Educational Management
PPIELE@OREGON.UOREGON.EDU

Elementary and Early Childhood Education
ERICEECE@UX1.CSO.UIUC.EDU

Handicapped and Gifted Children
ERICEC@GWUVM.GWU.EDU

Higher Education
JUDIERIC@GWUVM.GWU.EDU

Information Resources
ERIC@SUVM.ACS.SYR.EDU

Junior Colleges
EEH3RIE@MVS.OAC.UCLA.EDU

Languages and Linguistics
CAL@GUVAX.GEORGETOWN.EDU

Reading and Communication Skills
MMCCLAIN@UCS.INDIANA.EDU

Rural Education and Small Schools
U56D9@WVNVM.WVNET.EDU

Science, Mathematics, and Environmental Education
DPUGLISI@MAGNUS.ACS.OHIO-STATE.EDU

Social Studies/Social Science Education
HENSON@UCS.INDIANA.EDU

Teacher Education
ERICSP@GWUVM.GWU.EDU

Tests, Measurement, and Evaluation
NU_ERICTM@CUAVAX.DNET.CUA.EDU

Urban Education
LRY2@CUNIXF.CC.COLUMBIA.EDU

Adjunct Clearinghouses:

Art Education
HENSON@UCS.INDIANA.EDU

Consumer Education
CSEBONNER@EMUNIX.EMICH.EDU

Literacy Education
CAL@GUVAX.GEORGETOWN.EDU

U.S.–Japan Studies
OGUZERTE@UCS.INDIANA.EDU

Support Components:

ACCESS ERIC
ACCERIC@GWUVM.GWU.EDU

ERIC Document Reproduction Service
EDRS@GWUVM.GWU.EDU

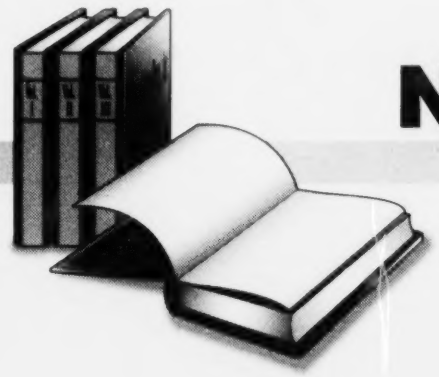
ERIC Processing and Reference Facility
ERICFAC@GWUVM.GWU.EDU

Oryx Press
ARHJB@ASUVM.INRE.ASU.EDU

In addition, ACCESS ERIC, the ERIC System's outreach and promotion component, maintains a bulletin board on America Online. Available through the Teachers' Information Network of the Learning and Reference folder, it includes general information about ERIC, the full text of five brochures for parents and teachers, product announcements, and a message center. Call 1–800–LET–ERIC for more information.

ERIC Document Reproduction Service Offers Free Bibliographies

Interested in materials on school restructuring, multiculturalism, learning styles, or cooperative learning? How about distance learning or sex education in the age of AIDS? The ERIC Document Reproduction Service has prepared 10 free bibliographies highlighting documents available on these and other timely education topics. The documents can be read in full on microfiche or in paper copy. To order your free bibliographies, call 1–800–443–3742.



K–12 Computer Networking Reading List

The following titles cover a range of issues regarding computer networks. Ordering information is included at the end of each entry. In addition, publications with an ED number have been abstracted and are in the ERIC database. You may read them on microfiche at more than 3,000 locations worldwide or order microfiche or paper copies from the ERIC Document Reproduction Service at 1–800–443–ERIC (3742). For details, contact ACCESS ERIC at 1–800–LET–ERIC (538–3742).

Computers and Opportunities for Literacy Development
Jo Anne Kleifgen, 1989

This ERIC Digest (#EDO–UD–89–4) cites several examples of ways that e-mail has been used to support literacy and English as a second language programs. Free with self-addressed stamped envelope (SASE). ERIC Clearinghouse on Urban Education, Institute for Urban and Minority Education, Box 40, Teachers College, Columbia University, New York, NY 10027; (212) 678–3433. Internet: LRY2@CUNIXF.CC.COLUMBIA.EDU.

Crossing the Internet Threshold
Roy Tennant, John Oper, and Anne G. Lipow, 1993

This instructional handbook, written by librarians, is designed to be used for learning and for further training. Provides both beginners' information and trainers' aids for all basic Internet functions. $45. Library Solutions Institute, 2137 Oregon Street, Berkeley, CA 94705. For information, send e-mail to ALIPOW@LIBRARY.BERKELEY.EDU.

Directory of Electronic Journals, Newsletters and Academic Discussion Lists, Second Edition
Michael Strangelove and Diane Kovacs, 1992

This complete directory describes electronic discussion groups and provides instructions for subscribing. Contents are arranged by subject. $25. Association of Research Libraries, Office of Scientific and Academic Publishing, 1527 New Hampshire Avenue NW, Washington, DC 20036. Electronic copies can be obtained by sending e-mail to LISTERV@KENTVM.BITNET. In the body of the message, type GET ACADLIST FILE1; GET ACADLIST FILE2; GET ACADLIST FILE3; GET ACADLIST FILE4; GET ACADLIST FILE5; GET ACADLIST FILE6.

FYI on Questions and Answers to Commonly Asked "New Internet User" Questions: Request for Comments 1325
Gary Scott Malkin and April N. Marine, 1992

This working memo provides complete answers to the most common questions about the Internet, including many technical subjects. Includes a lengthy glossary. Electronic copies available through anonymous file transfer protocol (FTP) at host ftp.nisc.sri.com, directory rfc, filename rfc1325.txt. User Services Working Group, Network Information Systems Center, SRI International, Room EJ291, 333 Ravenswood Avenue, Menlo Park, CA 94025; (415) 859–3695.

Internet Basics
Roy Tennant, 1992

This ERIC Digest (#EDO–IR–92–7) introduces the Internet computer network and provides an overview of the applications and resources the network provides. Specific topics include electronic mail, remote login (telnet), file transfer, and extended services such as WAIS, Gopher, and Archie. Free with SASE. ERIC Clearinghouse on Information Resources, 030 Huntington Hall, Syracuse University, Syracuse, NY 13244–2340; (315) 443–3640. Internet: ERIC@SUVM.ACS.SYR.EDU.

Internet Resource Guide
NSF Network Service Center (NNSC), 1989–

This directory of Internet-accessible resources includes computational resources, network information centers, library catalogs, archives, and more. $25 prepaid (note "4001–49–06480" on check). Bolt, Beranek and Newman, 10 Moulton Street, Mail Stop 6/3B, Cambridge,

(continued)

K–12 Computer Networking Reading List (continued)

MA 02138; (617) 873–3400. Electronic copies are available through anonymous FTP from host nnsc.nsf.net, directory resource-guide. Updates are available continuously. For more information, send e-mail to NNSC@NNSC.NSF.NET.

Internet-Accessible Library Catalogs and Databases
Art St. George and Ron Larsen, 1991–

This state-by-state directory of library catalogs accessible through the Internet fully describes each resource. Also includes instructions for accessing campus-wide information systems and dial-up libraries. Electronic copies available through anonymous FTP at host ariel.unm.edu, directory library, filename internet.library. For more information, send e-mail to Art St. George, Executive Network Services Officer, University of New Mexico; (505) 277–8046. Internet: STGEORGE@BOOTES.UNM.EDU.

Library Resources on the Internet: Strategies for Selection and Use
Laine Farley, editor, 1992

This guide gives instructions for remote access to library catalogs through telnet. Also includes information about how to locate library catalogs on the Internet, a discussion of gateways and clients, and a description of typical online catalog features. $18 members, $20 others. American Library Association Publications, 50 East Huron Street, Chicago, IL 60611; 1–800–545–2433. Electronic copies are available through anonymous FTP at host dla.ucop.edu, directory pub/internet, filename libcat-guide.

Mining the Internet
Computing Services, University of California (U.C.) Davis, 1991

Developed for use at a conference at U.C. Davis, this guide is a friendly introduction to Internet functions and resources in a scavenger hunt format. Contains some system-specific instructions that must be worked around. Electronic copies are available through anonymous FTP at host ucdavis.edu, directory ucs.netdocs, subdirectory mining. For information, call Computing Services, U.C. Davis, (916) 752–0233.

A National Information Network: Changing Our Lives in the 21st Century
Institute for Information Studies, 1992

This book contains a collection of essays exploring the many benefits, potential disadvantages, and issues associated with developing and managing a national information infrastructure. Technological, economic, and policy aspects of such a network are considered. The book is an annual review from the Institute for Information Studies, established by Northern Telecom and The Aspen Institute. $7.95. Contact the Publications Manager, Aspen Institute, Wye River House, P.O. Box 222, Queenstown, MD 21658; (410) 820–5433.

The National Research and Education Network (NREN): Promise of a New Information Environment
Ann P. Bishop, 1990

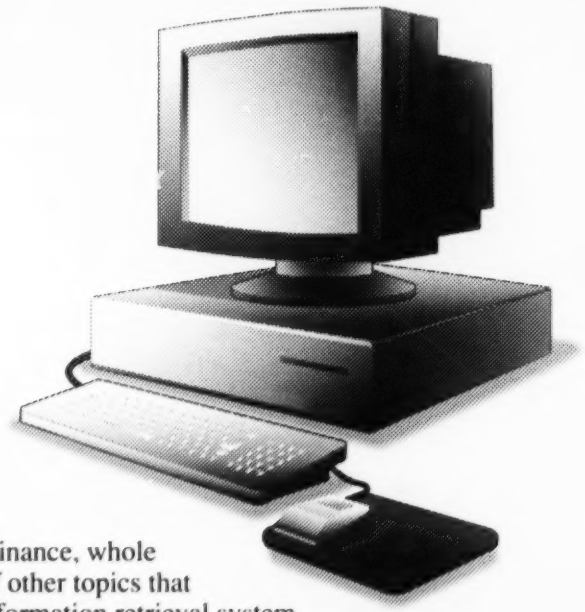
This ERIC Digest (#EDO–IR–90–4) describes the proposed legislation for NREN (as of late 1990) and the emergence of the electronic network as a general communication and research tool. Free with SASE. ERIC Clearinghouse on Information Resources, 030 Huntington Hall, Syracuse University, Syracuse, NY 13244–2340; (315) 443–3640. Internet: ERIC@SUVM.ACS.SYR.EDU.

The National Research and Education Network (NREN): Update 1991
Ann P. Bishop, 1991

This ERIC Digest (#EDO–IR–91–9) reports on federal policy initiatives related to NREN (as of late 1991) and discusses trends and issues in electronic networking as they pertain to members of the education and library communities. Free with SASE. ERIC Clearinghouse on Information Resources, 030 Huntington Hall, Syracuse University, Syracuse, NY 13244–2340; (315) 443–3640. Internet: ERIC@SUVM.ACS.SYR.EDU.

Query

the Best Minds in Education



No one can know all the ins and outs of school finance, whole language, hands-on science, and the hundreds of other topics that confront today's educators. With ***Query***, an information retrieval system for IBM personal computers and compatibles, you can find the answers you need from the full texts of more than 850 ERIC Digests.

Query combines award-winning search software and succinct essays produced by the 16 subject-specific ERIC Clearinghouses. The essay topics range from preschool programs to workplace literacy, from identifying science curriculum materials to training special education teachers. They summarize current issues in education, outline differing viewpoints, and answer key questions.

Query offers pull-down menus, simple instructions, and mouse support. You can locate relevant essays easily through keyword searching, then read them on the computer screen, print them, or copy them to disk. ***Query's*** search program can examine 200 titles in less than 1 second on a PC/AT.

The search program takes less than 200 kilobytes of storage space; the essay database requires 4 megabytes but may be stored on high-density diskettes if hard disk space is at a premium.

The list price for ***Query*** is $195. Librarians, superintendents, principals, teachers, school board members, and Parent–Teacher Association members are eligible to purchase ***Query*** at the educators' price of $150. To order, contact LMP Associates, 3109 Rolling Road, Chevy Chase, MD 20815; 1–800–243–1515, ext. ER.

"Networked Resources" in *Computers in Libraries*
Gord Nickerson, September 1991–

In this regular column (11 times a year), Gord Nickerson describes in detail the use of a particular Internet function or resource. *Computers in Libraries* (ISSN 1041–7915), Meckler Corporation, 11 Ferry Lane West, Westport, CT 06880; (203) 226–6967. For information, send e-mail to MECKLER@JVNC.NET.

New User's Guide to Useful and Unique Resources on the Internet, Version 2.3
NYSERNet, Inc., 1992

This guide provides directions for using a variety of resources on the Internet that can be accessed through FTP, telnet, or electronic mail. It includes databases, campus information systems, directories, library catalogs, FTP archives, bulletin board services, and more. $18 NYSERNet affiliates; $25 others. NYSERNet, Inc., 111 College Place, Syracuse, NY 13244–4100; (315) 443–4120. Internet: INFO@NYSERNET.ORG.

"Surfing the Internet: An Introduction" in *Wilson Library Bulletin*
Jean Armour Polly, Vol. 66, No. 10, pp. 38–42, June 1992

This Internet introduction shows librarians how they can benefit from network connectivity. Basic Internet resources and activities are described. *Wilson Library Bulletin* (ISSN 0043–5651), H.W. Wilson, 950 University Avenue, Bronx, NY 10452; 1–800–367–6770.

Surfing the Internet, Volume 2
Jean Armour Polly, December 1992

This updated resource guides librarians in their explorations of the Internet. It is available through anonymous FTP at host nysernet.org, directory pub/resources/guides, filename surfing.the.internet.2.0.2.txt.

Using Electronic Mail in an Educational Setting, Fastback 316
Dan H. Wishnietsky, 1991

This brief report describes uses of electronic mail/message systems in education for many purposes: recording grades, sending memos, accessing databases, communicating among faculty, allowing cooperative research, and developing multicultural curricula. $.90. Phi Delta Kappa, P.O. Box 789, Bloomington, IN 47402–0789. Also available from the ERIC Document Reproduction Service as ED 333 865. For information, call 1–800–443–ERIC.

The Whole Internet: User's Guide and Catalog
Ed Krol, 1992

This book explains what the Internet is and how it works and describes how to find resources on the network with tools such as Archie, Gopher, WAIS, and the World-Wide Web. It includes a catalog of more than 300 resources on topics from aeronautics to zymurgy, as well as a list of Internet service providers. $24.95. O'Reilly & Associates, Inc., 103 Morris Street, Suite A, Sebastopol, CA 95472.

Zen and the Art of the Internet, Second Edition
Brendan P. Kehoe, 1993

Aimed at the novice user, this book is intended to serve as a reference work and a foundation from which network users can explore the realm of Internet resources. $22. Prentice Hall, 200 Old Tappan Road, Old Tappan, NJ 07675; 1–800–922–0579. Electronic copies of the first edition are available free through anonymous FTP at host cs.widener.edu (147.31.254.132), directory pub/zen, filename zen-1.0.tar.Z, zen-1.0.dvi, and zen-1.0.PS.

Research in Action provides you with a synthesis of recent research findings on current trends and issues in education. These brief analyses cover a broad range of topics important, as well as practical, to educators, parents, and students. Each document reprinted in this column includes references to additional reading materials and information sources on related topics. Published by ERIC's 16 subject-specific clearinghouses as ERIC Digests, many are available free from individual clearinghouses, while others are available for a nominal fee. Subsequent issues of *The ERIC Review* will highlight current Digests from other ERIC Clearinghouses.

COMPUTER NETWORKS FOR SCIENCE TEACHERS

by Kimberly S. Roempler, The Ohio State University, and
Charles R. Warren, The Ohio Department of Education

Excerpted from ERIC Digest No. EDO–SE–93–1, ERIC Clearinghouse for Science, Mathematics, and Environmental Education

Computers and the technologies associated with them are major forces in the virtual shrinking of the globe. Formerly reserved for use by scientists, researchers, and computer buffs, computer networks now have capabilities that make them extremely useful to science teachers and their classes. Students and teachers across the United States and around the world can work together to share experiences and investigate local problems in a global context.

With a modem and a computer, one can "meet" science educators with common interests in almost any area of the country or the world, 24 hours a day. Telecommunications can add vitality and excitement to the classroom, enabling students and educators to contact individuals and organizations addressing issues such as tropical timber resources, environmental crises, and the AIDS pandemic.

Science classes can also communicate directly with other science classes around the world to conduct research or explore and share ideas. This kind of around-the-globe networking can be an exciting project for students of all ages. For example, in one recent effort, elementary school students from across the United States measured daily precipitation and the acidity of collected samples of rainwater. Students shared this information on a computer network with classes from many parts of the country and created a daily acid rain map. Science fairs and surveys can also be conducted online.

In addition to facilitating electronic mail and collaborative projects, networks can be used to retrieve resources. Science Line, EcoNet, and PSINets are prime examples of computer networks with a great deal to offer science educators.

Science Line, an electronic bulletin board sponsored by the National Science Teachers Association (NSTA), allows users to scan and download a variety of science and general interest programs, including public domain and shareware software, the latest information on summer programs and NSTA projects, official information files from government agencies and organizations, scientific papers on topics such as cold fusion, and teacher aids such as gradebook programs and classroom demonstrations.

EcoNet is an international computer network related to the environment and education. EcoNet serves environmen-

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tal educators as part of its broad mission to provide information services to the international environmental community. As a central program of the Institute for Global Communications, EcoNet allows users to interact with colleagues on other continents, gather the latest information on a wide variety of environmental topics, look for jobs in the environmental field, and locate possible funding sources for projects.

PSINets, initiated in 1985, are People Sharing Information Networks that have been established in various states, including Iowa, Georgia, and Ohio, with the cooperation of IBM and the Council of State Science Supervisors. Typical conferences currently available on these networks include curriculum materials, announcements, forums, surveys, projects, phonebooks, and student activities.

On the state level, PSINets have met with great success. In Ohio, for example, every school district was offered inservice training on the use of PSINets, and more than half acquired the software necessary to use OHNet, the Ohio PSINet. A toll-free number was established by the Science Council of Ohio and the Ohio Department of Education to enable science teachers and administrators to access the network without incurring telephone charges. Through OHNet, Ohio teachers learn about local, state, and national science education resources, trends, and curriculum developments. State-level PSINets are networked to national PSINets such as the Council of State Science Supervisors', and to PSINets in other states. Plans for the growth of PSINet involve a software version for Macintosh computers and a link to the Internet.

One of the most common complaints of science teachers is the feeling of isolation from other professionals with similar interests. Computer networks allow teachers to "reach out and touch someone" by sharing ideas and activities on electronic bulletin boards. Networks can also act as resource retrieval databases. Data retrieved from computer networks can be analyzed by students. In short, using computer networks can increase productivity, creativity, and professional activity.

Most computer networks can set up an account and a password over the telephone. Research and history involving networks tell us that successful networks depend on three factors: (1) involved users on the system, (2) active paper mail support, and (3) occasional face-to-face meetings between users. For more information about the science networks described here, contact:

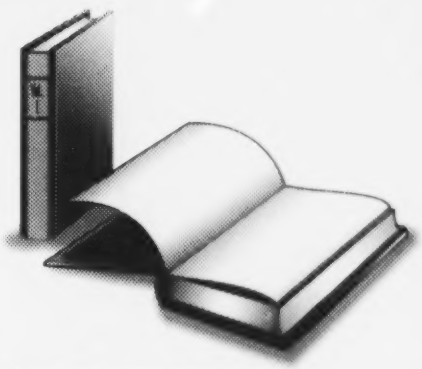
Science Line
National Science Teachers Association
1742 Connecticut Avenue NW
Washington, DC 20009
(202) 328–5853

EcoNet
Institute for Global Communications
3228 Sacramento Street
San Francisco, CA 94115
(415) 923–0900

To find out about the PSINet network within your state, contact the science or mathematics consultant at your state department of education or:

Jack Gerlovich, National Director
PSINet
Center for Teacher Education
Drake University
Des Moines, IA 50311
(515) 271–3912

The U.S. Department of Education's Office of Educational Research and Improvement (OERI) announces New Postsecondary Directory



1991–92 Directory of Postsecondary Institutions, Volumes 1 and 2

National Center for Education Statistics
Volume 1, $33; Volume 2, $22

Provides the following information about each of the nation's 10,144 postsecondary institutions: contact information, control or affiliation, highest level of award, program types, nationally recognized accreditations, enrollment, and costs. Volume 1 (#065–000–005336) includes listings for 4-year and 2-year programs; Volume 2 (#065–000–005344) covers postsecondary programs that may be completed in less than 2 years.

Both volumes may be ordered from the Superintendent of Documents, U.S. Government Printing Office, Mail Stop: SSOP, Washington, DC 20402–9328; (202) 783–3238.

ERIC New Titles in Education

This column features new publications produced or distributed by the ERIC Clearinghouses. To order, contact the appropriate organizations directly and make your check or money order payable to them.

For readers interested in other education titles, the *Catalog of ERIC Clearinghouse Publications* is a comprehensive listing of free and low-cost education materials produced by the Clearinghouses and support components of the ERIC System. To order the *Catalog*, send a check or money order for $10 to ACCESS ERIC, 1600 Research Boulevard, Rockville, MD 20850–3172.

Adult, Career, and Vocational Education

Order this publication from the Center on Education and Training for Employment, 1900 Kenny Road, Columbus, OH 43210–1090; 1–800–848–4815.

The ABLE Sampler: A Professional Development Guide for Adult Literacy Practitioners, 1991
Sherry Royce, editor
SN 66; $7 plus $3.25 postage and handling

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